Ecological Indication, Bioaccumulation, and Phytoremediation as Tools for Environmental Quality Management

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Currently many areas exist that are contaminated as a result of man-made activities. Examples of such areas that came into existence by Corps of Engineers' activities since the mid-sixties are upland Confined Disposal Facilities (CDFs) for dredged material. In the course of accomplishing its mission of maintaining and improving navigation in waters of the United States, the USACE annually handles about 300 million cubic m of dredged material. Five to ten percent of this material is not suitable for unrestricted open-water disposal. Heavy metals and recalcitrant organic compounds, such as PCBs, PAHs and PCDDs/Fs) have drawn attention as threats to ecological and human health. Prior to the dredging itself, the sediments to be dredged are chemically characterized, and the decision to place a preset part of the total volume of dredged material into a CDF is based on these chemical results. However, after placement of the dredged material in the CDF considerable uncertainty exists as to where the contamination is, what the levels are, and whether the contamination accumulates in the plants and animals colonizing or visiting the CDF. Many CDFs are nearing or exceeding design capacity. Acquisition of land for new CDFs is difficult because potentially suitable land areas near dredging locations are already in use and undeveloped land near dredging areas are often composed by wetlands whose ecological value make them too valuable for use as a CDF. A solution to the latter problem is to extend the service life of existing CDFs as much as possible.

Chemical methods to explore types and levels of contamination, and chemical/physical and mechanical methods for cleanup of contaminated sediments exist, are very costly, but do not give insight in environmental toxicity. Biological methods are currently explored that can: (1) indicate toxicity (level and spatial extent), bioaccumulation and potential for trophic transfer; and (2) remove contaminants by root uptake and subsequent transport to shoots, or prevent contaminants from leaving the CDFs in whatever form, such as leachate, runoff, trophic transfer (phytoremediation). Examples from on-going research will be presented.